Activity Title: NOAA Ships – What, Where, Why, How?

Subject (Focus/Topic): Students will investigate the three different types of NOAA vessels and the research on-board: hydrographic surveys, oceanographic research, and fisheries surveys.

Grade Level: 9^{th} - 12^{th} grade (can easily be adjusted for middle schoolers)

Average Learning Time: Students have two or three 45-min class periods (depending on the level of your students and how you adjust the activity) to complete research on their NOAA ship and one 45-min class period to complete the Ship Scavenger Hunt.

Lesson Summary (Overview/Purpose): Students will create a poster on one of the NOAA vessels using information found online, followed by a Ship Scavenger Hunt for students to explore the other ships. This is a great introductory activity to many topics and can be used in a variety of science classes – biology, chemistry, earth science, environmental science – with a shift in the focus of the activities following this lesson. Much of the information from this lesson comes from the student products and discussions with the teacher.

Overall Concept (Big Idea/Essential Question): How do the NOAA vessels support NOAA's mission?

Specific Concepts (Key Concepts):

- NOAA's mission is Science, Service, and Stewardship:
  To understand and predict changes in climate, weather, oceans, and coasts,
  To share that knowledge and information with others, and
  To conserve and manage coastal and marine ecosystems and resources.
- NOAA's Office of Marine and Aviation Operations (OMAO) research and survey ships compose the largest fleet of federal research ships in the nation. The fleet ranges from large oceanographic research vessels capable of exploring the world's deepest ocean, to smaller ships responsible for charting the shallow bays and inlets of the United States. The fleet supports a wide range of marine activities including fisheries research, nautical charting, and ocean and climate studies. *(from http://www.omao.noaa.gov/)*
- The data collected from the NOAA vessels ranges from the bottom of the ocean floor all the way to the atmosphere and are used to support the mission of NOAA.

Focus Questions (Specific Questions):

- What are the three types of research vessels in the NOAA fleet?
- How do the NOAA research vessels support NOAA's mission?

- How do oceanographic/atmospheric research vessels collect data?
- How do hydrographic ships collect data and make nautical charts?
- How do fisheries vessels collect data and make decisions regarding fisheries management?
- Who collects data on the ships?
- What are the different roles of the members on-board the ship?

Objectives/Learning Goals:

- ✓ Given a list of NOAA ships, students will research information on the ship and create a completed poster with factual information.
- ✓ Provided informational posters with information on NOAA ships, students will be able to correctly answer 80% of the questions on the Ship Scavenger Hunt.
- ✓ Given examples of data collected from a specific NOAA ship, students will be able to identify the type of ship from which this data is collected with 80% accuracy.
- ✓ Utilizing information from the lesson and teacher-provided videos and discussions, students will be able to complete a post-assessment with 80% accuracy.
- ✓ Provided data collected from a NOAA ship, students will be able to make a claim with supporting evidence and proper reasoning to answer a given question.

Background Information:

This lesson is useful as an introduction to NOAA and some of the research that occurs on-board the ship. There is very little prior knowledge needed for students to succeed. They should be familiar with using the internet to research information, and potentially using a computer-based way to present the information. It is also a great opportunity for the teacher to interact with students as they discover the science and research behind the ships.
Common pitfalls: Students may have trouble with the shiptracker.noaa.gov website if their vessel is currently in port. They also may not be able to find all of the information on every ship easily.

Common Misconceptions/Preconceptions: State any common preconceived ideas or misconceptions that students may have about the topic of the lesson.

- NOAA ships are similar to fishing boats or other ships/boats that they've been on.
- There is an infinite number of fish in the ocean.
- We do not have good estimates for the number of fish in the ocean, only guesses.
- NOAA fisheries research vessels are killing large numbers of fish to collect data, similar to what they've seen on shows like *The Deadliest Catch*.
- Fish can reproduce quickly and easily.
- We have nautical charts and maps of the entire ocean floor.
- You cannot collect data for the weather from the ocean.

Materials: List all the materials necessary to teach this lesson.

- TAS photos, videos, and blogs
- Poster materials: construction paper/posterboard, markers, glue/tape
- Handouts: blank shiptracker map for students to plot their ships' course, copies of the Ship Scavenger Hunt

Technical Requirements: computer, projector, student access to computers, internet

Teacher Preparation:
Teacher should be familiar with some of the research on-board the various types of ships. A Teacher at Sea will likely be most familiar with the type of vessel they were aboard, but not the other two. Teacher can decide to either have students write questions to include in the Ship Scavenger Hunt or teacher should write their own questions. There is actually not a lot of physical preparation for the teacher.

Keywords: NOAA, scientific research, sustainability, nautical mapping, oceanographic data

Pre-assessment Strategy/Anticipatory Set (Optional):

1. Teacher asks students "What is NOAA?"
   Student responses will vary. Some may never have heard of NOAA before.
2. Teacher gives student pre-assessment questions and allows for 10-15min to complete.
3. Teacher shows introductory video: One NOAA
   https://www.youtube.com/watch?v=nBnCsMYm2yQ
   Following video, teacher goes through all the areas that NOAA covers.
4. A Teacher at Sea Alumni can introduce their specific NOAA ship and scientific research on board, if desired.
5. Teacher asks students "What are some more specific examples of how NOAA research could be useful for society?"
   Student responses will vary. Some possible ideas: sustainable fishing, *Titanic* expeditions, BP/Gulf Oil Spill, Tsunami debris, Fukushima Daiichi disaster, hurricane hunters, tsunamis, deep sea explorations, underwater volcanoes

Lesson Procedure: List the specific steps to follow in order to teach the lesson.
Day 1:

- Introduce NOAA (see pre-assessment strategy/anticipatory set above).
- Teacher can decide to use additional NOAA videos listed in the Additional Resources section below now or at the end of class, depending on the focus of the class/lesson.
- Have students sign-up for a specific ship.
- Students begin on-line research.

Days 2 & 3:

- Teacher can decide to use additional NOAA videos listed in the Additional Resources section below at the beginning or the end of class, depending on the focus of the class/lesson.

- Students continue on-line research.
- Students create poster either on construction paper, poster board, or on-line (depending on teacher preference).
- Students generate 5-6 questions (and answers) based on the scientific research on their specific vessel - tell them to find interesting facts. ☺
- Students hang completed posters around the room (if teacher chooses to use on-line resources to create the poster, an alternative method to display finished products should be chosen).
- Teacher uses student questions to create/print/copy the Ship Scavenger Hunt.

Day 4:
- Student's move around the room to complete the Ship Scavenger Hunt to explore how the ships contribute to NOAA's mission.
- Teacher can decide to use additional NOAA videos listed in the Additional Resources section below at the beginning or the end of class, depending on the focus of the class/lesson.

Assessment and Evaluation:

✓ Objective: Given a list of NOAA ships, students will research information on the ship and create a completed poster with factual information.
Assessment: final poster (graded with rubric found in lesson plan)

✓ Objective: Provided informational posters with information on NOAA ships, students will be able to correctly answer 80% of the questions on the Ship Scavenger Hunt.
Assessment: Ship Scavenger Hunt answers (questions, and thus answers, will vary)

✓ Objective: Given examples of data collected from a specific NOAA ship, students will be able to identify the type of ship from which this data is collected with 80% accuracy.
Assessment: NOAA data analysis worksheet (found in lesson plan)

✓ Objective: Utilizing information from the lesson and teacher-provided videos and discussions, students will be able to complete a post-assessment with 80% accuracy.
Assessment: same questions as pre-assessment

✓ Objective: Provided data collected from a NOAA ship, students will be able to make a claim with supporting evidence and proper reasoning to answer a given question.
Assessment: CER question (found in lesson plan)

Standards:
National Science Education Standard(s) Addressed:
Content Standard A: Science as inquiry
Content Standard E: Science & technology
Content Standard F: Science in personal and social perspectives

Ocean Literacy Principles Addressed:
Ocean Literacy Principles can be found at
http://www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf

Ocean Literacy Principle #1: The Earth has one big ocean with many features.

Fundamental Concepts:

A – The ocean is the defining physical feature on our planet Earth—covering approximately 70% of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian, Southern, and Arctic

B – Ocean basins are composed of the seafloor and all of its geological features (such as islands, trenches, mid-ocean ridges, and rift valleys) and vary in size, shape and features due to the movement of Earth's crust (lithosphere). Earth's highest peaks, deepest valleys and flattest plains are all in the ocean.

H – Although the ocean is large, it is finite, and resources are limited

Ocean Literacy Principle #3: The ocean is a major influence on weather and climate.

Fundamental Concepts:

A – The interaction of oceanic and atmospheric processes controls weather and climate by dominating the Earth's energy, water, and carbon systems

Ocean Literacy Principle #7: The ocean is largely unexplored.

Fundamental Concepts:

A – The ocean is the largest unexplored place on Earth—less than 5% of it has been explored. The next generation of explorers and researchers will find great opportunities for discovery, innovation, and investigation.

C – Over the last 50 years, use of ocean resources has increased significantly; the future sustainability of ocean resources depends on our understanding of those resources and their potential.

D – New technologies, sensors, and tools are expanding our ability to explore the ocean. Scientists are relying more and more on satellites, drifters, buoys, subsea observatories, and unmanned submersibles.

E – Use of mathematical models is an essential part of understanding the ocean system. Models help us understand the complexity of the ocean and its interactions with Earth's interior, atmosphere, climate, and land masses.

F – Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists,

meteorologists, physicists, animators, and illustrators. And these interactions foster new ideas and new perspectives for inquiries.

Maryland State Science Standards Addressed:

Goal 2: Concepts of Earth/Space Science

Expectation 2.1 The student will identify and describe techniques used to investigate the universe and Earth.

Indicator 2.1.2 The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the atmosphere, land and water on Earth.

Goal 3: Concepts of Biology

Expectation 3.6 The student will investigate a biological issue and develop an action plan.

Indicator 3.6.1 The student will analyze the consequences and/or trade-offs between technological changes and their effect on the individual, society, and the environment. They may select topics such as bioethics, genetic engineering, endangered species, or food supply.

Goal 6: Environmental Science

Expectation 6.4 The student will develop and apply knowledge and skills gained from an environmental issue investigation to an action project which protects and sustains the environment.

Indicator 6.4.1 Identify an environmental issue and formulate related research questions.

Indicator 6.4.3 Interpret the findings to draw conclusions and make recommendations to help resolve the issue.

Indicator 6.4.5 Analyze the effectiveness of the action project in terms of achieving the desired outcomes.

Additional Resources:

NOAA YouTube channel
https://www.youtube.com/user/noaa

Christening and Launch of the NOAA Ship Reuben Lasker – June 16, 2012 (0:47 min)
https://www.youtube.com/watch?v=dSF8u7hvWtU&list=UUe9IxQeBttZIYl5c43ycf9g

Deep-Ocean volcanoes (1:50 min)
https://www.youtube.com/watch?v=XGTRtkYqnho&list=UUe9IxQeBttZIYl5c43ycf9g
West Mata underwater volcano eruption (0:50 min)
https://www.youtube.com/watch?v=Ft1bd3xITQ4&list=UUe9IxQeBttZIYl5c43ycf9g
optional tie-ins: use of ROV Jason, eruption in Pacific Ocean in the Ring of Fire

Arctic Exploration (2:56 min)
https://www.youtube.com/watch?v=GumtAV_KsxA&list=UUe9IxQeBttZIYl5c43ycf9g
Arctic Sea Ice Sets Record Low (2012 report) (2:43 min)
https://www.youtube.com/watch?v=BT6qC78u3nA&list=UUe9IxQeBttZIYl5c43ycf9g
optional tie-in: climate change

Fish Sampling near Pascagoula, MS – May 6, 2010 (0:57 min)
https://www.youtube.com/watch?v=SayYmOHoypw&list=UUe9IxQeBttZIYl5c43ycf9g
Seafood Sampling by NOAA in Response to the BP/Gulf Oil Spill (2:39 min)
https://www.youtube.com/watch?v=pantl8WYynE&list=UUe9IxQeBttZIYl5c43ycf9g
optional tie-in: Deepwater Horizon oil spill

NOAA Ship *Okeanos Explorer* Education Materials Collection: Why Do We Explore? and How Do We Explore? (PDF available online)
http://oceanexplorer.noaa.gov/okeanos/edu/collection/wdwe.html

Why Accurate Fish Stock Assessments Matter
http://www.chefscollaborative.org/2011/11/30/why-accurate-fish-stock-assessments-matter/

Ecosystems Surveys
http://www.nefsc.noaa.gov/femad/ecosurvey/mainpage/welcome_aboard.html

Longline Surveys
http://www.sefsc.noaa.gov/labs/mississippi/surveys/longline.htm

Groundfish Analysis
https://swfsc.noaa.gov/GroundfishAnalysis/

Marine Protected Areas
http://www.sefsc.noaa.gov/labs/panama/mp/mpa.htm

Other information can be found on individual Teacher at Sea pages when you look under their name where it says clicking here.

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NOAA Pre- & Post-Assessment

NOAA is the National Oceanographic and Atmospheric Administration. Answer the following multiple-choice questions to the best of your ability.

1. NOAA is part of the United States Department of
   a. Defense
   b. Commerce
   c. Agriculture
   d. Transportation
   e. Energy

2. The NOAA Commissioned Officer Corps is one of the seven uniformed services of the United States (similar to the Army, Air Force, Marine Corps, etc.).
   a. true
   b. false

3. Which of the following is NOT an office of NOAA?
   a. National Weather Service
   b. National Ocean Service
   c. National Marine Fisheries Service
   d. National Environmental Satellite, Data, and Information Service
   e. National Atmospheric Service

4. Some NOAA ships have been around (and still functioning) for over __ years.
   a. 15
   b. 20
   c. 35
   d. 45
   e. 60

5. One way that NOAA ships locate fish in the ocean uses
   a. Fishing poles
   b. catch & release
   c. hydroacoustics
   d. ocean current data
   e. GPS

6. To date, we have explored less than __% of the ocean.
   a. 5
   b. 10
   c. 20
   d. 30
   e. 50

7. Which of the following is NOT a type of NOAA research vessel?
   a. hydrographic survey
   b. oceanographic & atmospheric research
   c. fisheries survey
   d. submarine explorations

8. NOAA ships operate in
   a. Alaska
   b. West Coast
   c. Gulf of Mexico
   d. East Coast
   e. Hawaii
   f. all of the above

9. NOAA ships were NOT involved in which of the following?
    a. discoveries about the *Titanic*
    b. BP/Gulf Oil Spill
    c. Hurricane Katrina
    d. 1999 JFK, Jr. airplane crash
    e. Gulf War impacts
    f. they were involved in all of the above

10. The main campus of NOAA is located in
    a. Washington, D.C.
    b. Seattle, Washington
    c. Key West, Florida
    d. Silver Spring, Maryland
    e. San Diego, California

Answer Key

1. B
2. A
3. E
4. D (Oregon II)
5. C
6. A
7. D
8. F
9. F
10. D

NOAA SHIPS PROJECT

TASK: create a legible, aesthetically pleasing hand-made poster on one of the NOAA ships *(OPTIONAL: create the poster online using padlet.com or another pre-approved option)*

1. SIGN UP for the ship with your teacher.

2. Use the internet to investigate information about your ship. Be sure to focus on the SCIENTIFIC RESEARCH on your ship.
   At a minimum, you must include:
   - name of the ship
   - when/where it was launched
   - when/where it was commissioned
   - who/what/where its name comes from
   - home port
   - what type of research it does (fisheries, hydrographic, oceanographic/atmospheric) and how the results are used scientifically
   - how the research meets NOAA's mission
   - current commanding officer (CO)
   - a map showing either its current cruise or where it has been over the last 365 days (you will need to use http://shiptracker.noaa.gov - some ships are in "winter inport", so they have not moved recently)
   - recent location data (also from the shiptracker website – date, time, lat, long, ship speed, water temp, air temp)
   - another fun fact of your choice

3. Create your poster!

OPTIONAL:

4. *Create 3 questions for your peers to discover about your ship in a Ship Scavenger Hunt – choose interesting facts!*

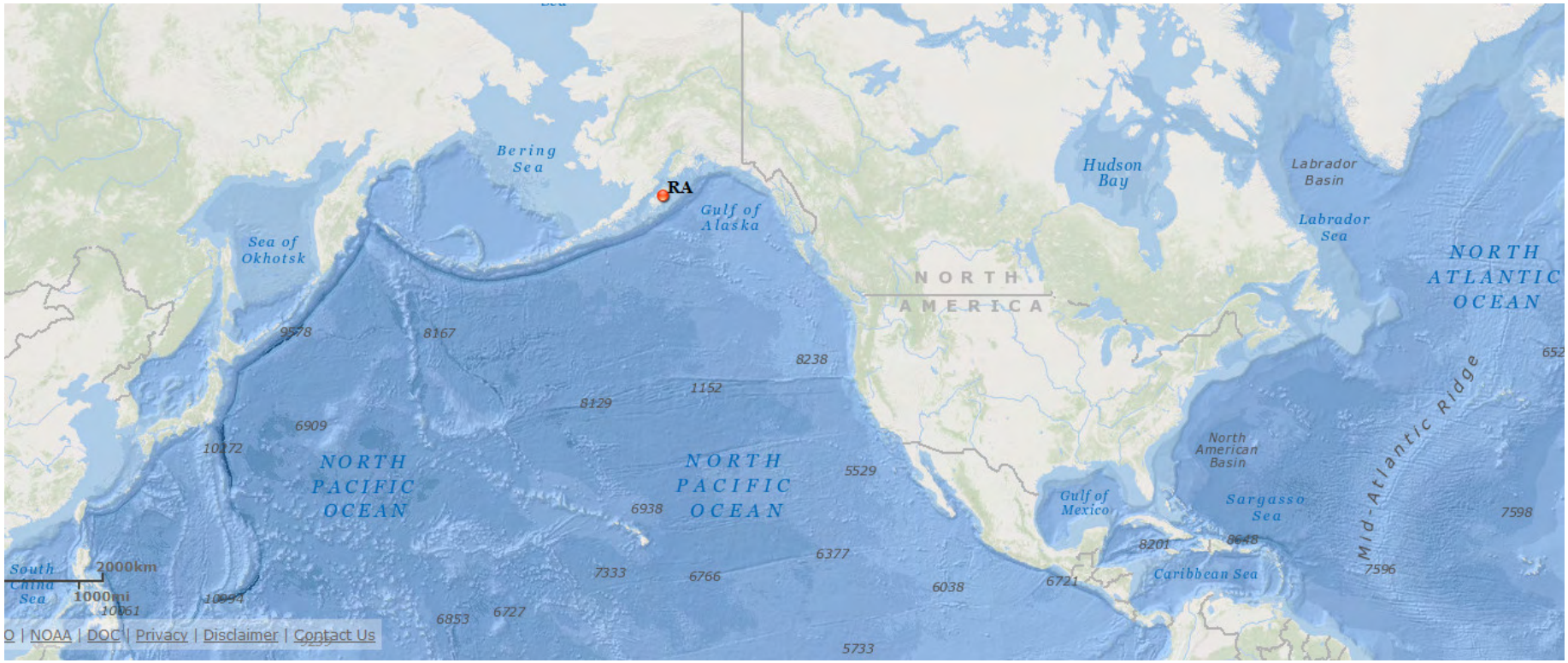
Tips for using shiptracker.noaa.gov:

- Click on **Filters** on the left side
- Under *Entire Fleet*, select your ship
- Click on the empty box below your ship name & select the current cruise
- If no transect lines appear on the map (due to a ship being in port), continue selecting a cruise until you find one
- Click on **Info** on the left side and **Cruise Info** and Display Sparse Data Points to find date, time, lat, long, speed, water temp, air temp
- *OPTIONAL: Click on **Layers** on the left side and overlay Nautical Charts or Topo Map to discover additional information based on the level of your students*

Ship Sign-Up

Ship Name	**Student Name(s)**
ATLANTIC FLEET * ATLANTIC FLEET * ATLANTIC FLEET * ATLANTIC FLEET	
Ronald H. Brown	
Henry B. Bigelow	
Ferdinand Hassler	
Nancy Foster	
Gordon Gunter	
Okeanos Explorer	
Thomas Jefferson	
Oregon II	
Pisces	
PACIFIC FLEET * PACIFIC FLEET * PACIFIC FLEET * PACIFIC FLEET	
Oscar Dyson	
Bell M. Shimada	
Rainier	
Fairweather	
Reuben Lasker	
McArthur II	
PACIFIC ISLANDS FLEET * PACIFIC ISLANDS FLEET * PACIFIC ISLANDS FLEET	
Hi'ialakai	
Ka'imimoana	
Oscar Elton Sette	

SHIPTRACKER



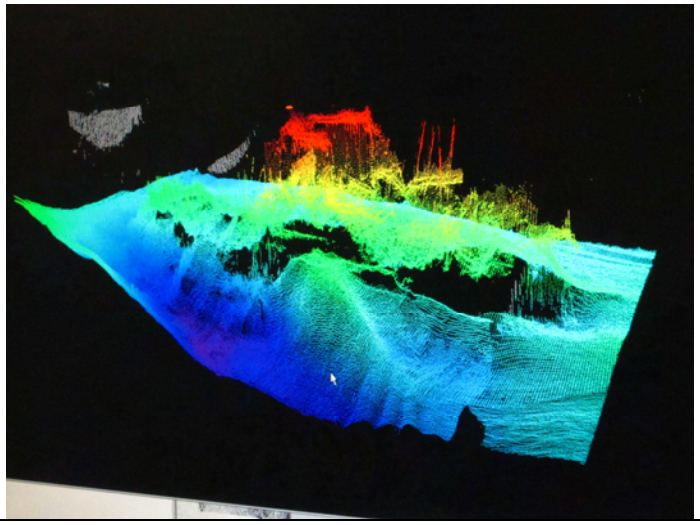
SHIPTRACKER

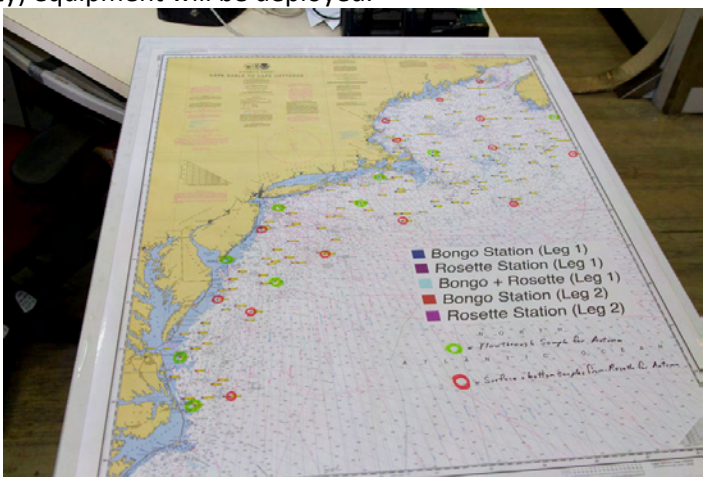
Ship Rubric

Your Points	Possible Points	Requirement
	5	name of the ship
	5	when/where it was launched
	5	when/where it was commissioned
	5	who/what/where its name comes from
	5	home port
	30	type & description of research
	15	meeting NOAA's mission
	5	current CO
	5	labeled shiptracker map
	5	recent location data
	5	fun fact
	5	Legibility
	5	aesthetics (color, design)
	100	**TOTAL SCORE**

NOAA data analysis worksheet

Ship Name	Data/Research Description	Fisheries (F), Oceanographic/ Atmospheric (O), Hydrographic (H) *(circle one)*
Oregon II	"There are several measurement tools we use. The measuring board allows us to place a small shark on the board and read its length in millimeters. We take two readings – one for the length from the snout to the fork where the tail splits, the other for the entire length of the shark from end to end. The spring scale is used to measure the shark's weight in kilograms. If the shark is too big for either of the above tools, we will take measurements in the cradle. We use a flexible tape measure for length, and record weight through a scale on the cradle. We know the cradle's weight, so all we have to do is record the total weight of the cradle with the shark in it and subtract." [1]	F O H
R/V Fulmar	"The science team was divided into two groups: those working on the flying bridge at the bow or front of the vessel and those working on the back deck with nets. On the flying bridge there were three observers, two on either end, the port (left) and the starboard (right), who would spot all marine mammals. An ornithologist on board would identify birds. The other member recorded what the animal was, where it was, how many there were and what the organisms were doing. Sometimes there was a lot going on at one time and they would use a second recorder temporarily to document all the animals. The data is always gathered in this way. They spotted 50 whales: 10 blues and 40 humpbacks; some breaching, some tail lobbing. We documented 16 different species of birds." [2]	F O H
R/V Walton Smith	"The flurometer is a piece of equipment attached to the CTD which is being used on this cruise to measure the amount of chlorophyll (specifically chlorophyll_a) in the water being sampled. It works by emitting different wavelengths of light into a water sample. The phytoplankton in the sample absorb some of this light and reemit some of it. The flurometer measures the fluorescence (or light that is emitted by the phytoplankton) and the computer attached to the CTD records the voltage of the fluorescence. The flurometer can be used to measure other characteristics of water, but for this research cruise, we are measuring chlorophyll. As you know, chlorophyll is an indicator of how much phytoplankton is in the water. Phytoplankton makes up the base of the marine food web and it is an important indicator of the health of the surrounding ecosystem." [3]	F O H

Rainier	"During Sunday's launch survey we had to clean up some "Holidays" and acquire some cross line data. The word "Holiday" might lead to some confusion about what you might think we are doing when you read that word. Holiday =vacation right? In this case, it is when there is a gap, or missing information, in the survey data that is acquired. This poses a problem for the survey technicians because this leaves holes in the data that they must use for their final charts. The speed, direction, weather, swells, rocking of the boat, and the launches making wider turns than anticipated. It is easy to see where holidays occur as we are surveying because amidst the rainbow of color there will be a white pixel or square showing that data is missing." [4]	F O H
Bell M. Shimada	"For me, the real excitement began once the fish began pouring onto a conveyor belt into the fish lab. First, we sorted the fish by species. In the first haul, the fish were mostly hake, as intended, but we also caught three yellow-tail rockfish and three eulachons, a type of smelt. In the second haul, there was largely yellow-tail rockfish and hake, with several Pacific Ocean perch and widow rockfish. The rockfish were difficult to sort: they have dangerous spines and fight hard. A fisheries biologist on the acoustics team taught me how to pick them up with one hand over their eyes and the other firmly grasping their tails. Even so, we both had a few close calls. We threw most of the fish right back into the ocean but kept about three hundred hake to sex and scale." [5]	F O H
Pisces	"A team member places each container on a digital scale and calls out the weights loud enough for the data recorder to hear above the din of the equipment in the background. The team sets up in assembly line fashion to measure and record length of each fish. One or two people line up the still-lively fish while two stand at measuring boards, hold the fish flat to measure snout to tail, and then release them through a chute back into their ocean habitat. Only the individuals needed for further study are kept, frozen for later processing." [6]	F O H
Thomas Jefferson	"Shipwreck profile (from the side). The grey stuff in back is a school of fish." [7] 	F O H

Gordon Gunter	"We are currently at the Naval Station in Newport, Rhode Island and we will head up to the Gulf of Maine to start our Ecosystem Monitoring Survey. During the survey, we will deploy our equipment and gather data at about 120 fixed stations and 25 random ones from the Gulf of Maine down to Norfolk, Virginia. At each station a Bongo Net (phytoplankton) and/or CTD Rosette (salinity, temperature, and density) equipment will be deployed." [8] 	F O H
Oscar Dyson	"Here are several hundred pollock we have to sort from a typical catch! We toss the females in the "Sheilas" side and the males in the "Blokes" side!" [9] 	F O H
Fairweather	"Four such boats were deployed from the *Fairweather* that morning. They all use 400 kilohertz multi-beam sonar to map the bottom of the channels we are currently in, near Ketchikan, AK. This type of SONAR sends out 512 beams/ping of sound, and is most effective in shallow water. The area or swath that can be scanned at anytime is about 5 times the depth of the water. Therefore in shallow water the swath is much narrower and in deeper water the swath is much wider. Most of the work today on all of the launches was filling in small areas in the chart in which data was missing or not dense enough to complete the project." [10]	F O H

References:

[1] http://teacheratsea.wordpress.com/2011/08/03/maureen-anderson-data-and-measurement-july-31-2011-post-4/

[2] http://teacheratsea.wordpress.com/2011/08/12/elaine-a-survey-on-the-rv-fulmar-july-21-2011/

[3] http://teacheratsea.wordpress.com/2011/12/14/elizabeth-bullock-day-3-december-13-2011/

[4] http://teacheratsea.wordpress.com/2011/10/04/kaci-heins-surveying-and-processing-september-30-october-3-2011/

[5] http://teacheratsea.wordpress.com/2011/08/08/caitlin-thompson-going-fishing-august-4-2011/

[6] http://teacheratsea.wordpress.com/2011/05/24/8930/

[7] http://teacheratsea.wordpress.com/2011/11/04/paige-teamey-october-31-2011-november-1-2011/

[8] http://teacheratsea.wordpress.com/2013/06/05/sue-cullumber-a-slight-delay-and-eagerly-awaiting-departure-june-5-2013/

[9] http://teacheratsea.wordpress.com/2012/08/05/johanna-mendillo-how-well-do-you-know-your-pollock-august-4-2012/

[10] http://teacheratsea.wordpress.com/2010/05/20/david-altizio-may-19-20-2010/

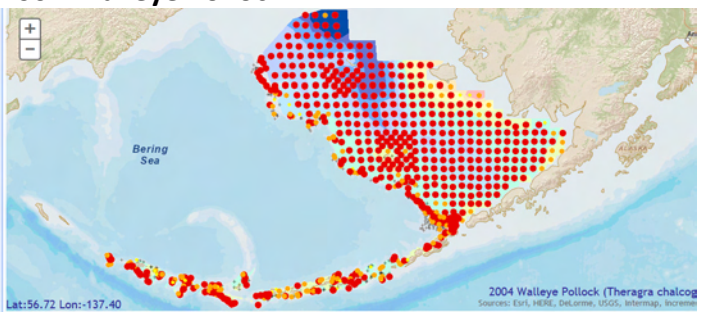
Answers:

1. F
2. O
3. O
4. H
5. F
6. F
7. H
8. O
9. F
10. H

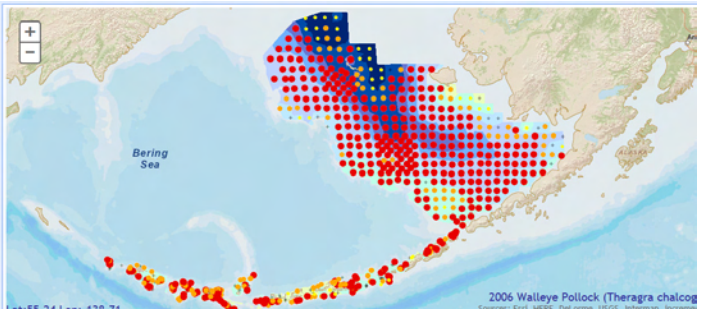
Claim-Evidence-Reasoning question

If you press play on the bottom left of the website referenced below the data table, you can see how the RACE (Resource Assessment and Conservation Engineering) Groundfish Survey data is collected in both the Bering Sea and the Gulf of Alaska.

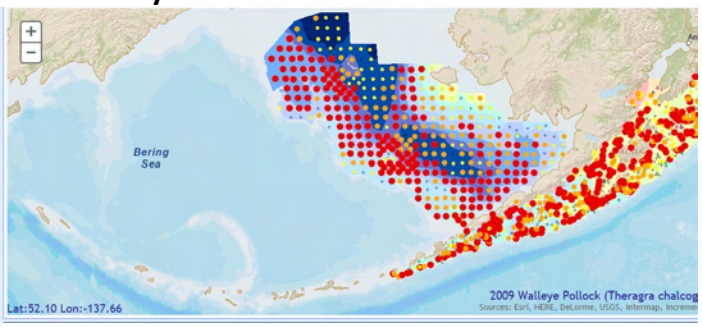
2004 Walleye Pollock



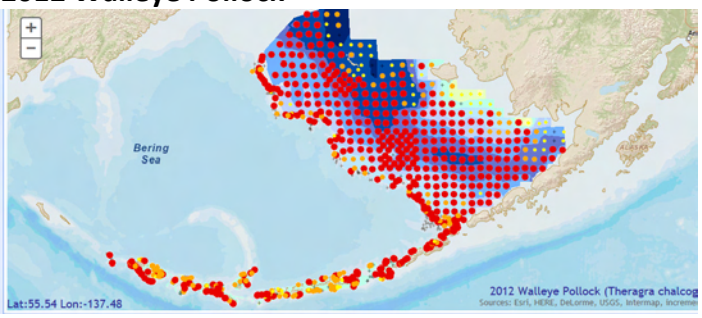
2006 Walleye Pollock

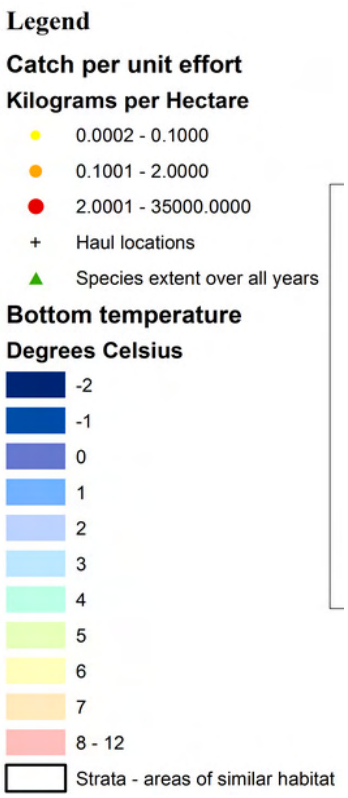


2009 Walleye Pollock



2012 Walleye Pollock





Station Data	Station	**M-04**		**M-20**		**R-25**	
	Latitude	58.991		59.011		60.658	
	Longitude	-165.933		-169.834		-173.465	
	Bottom Depth (m)	30		63		66	
	Bottom Temp (^{o}C)	4.7		-0.8		-1.0	
		kg/hectare	**#/hectare**	**kg/hectare**	**#/hectare**	**kg/hectare**	**#/hectare**
Year	2004	7.93	6.64	100.67	116.50	113.09	141.32
	2005	2.98	2.35	29.74	35.36	64.91	60.72
	2006	8.81	35.94	4.45	10.62	28.27	21.94
	2007	---	---	0.23	26.18	2.25	298.38
	2008	---	---	1.22	13.03	4.64	3.18
	2009	0.01	2.07	7.81	160.38	0.58	4.85
	2010	---	---	---	---	3.85	11.16
	2011	1.51	0.49	39.20	31.18	46.66	34.71
	2012	5.71	30.06	25.09	45.47	52.13	33.90
	2013	2.07	0.67	---	---	51.33	67.75

* 1 hectare = 10,000 m^2 = 0.00386 mi^2

Data modified from http://www.afsc.noaa.gov/RACE/groundfish/survey_data/default.htm

Walleye pollock, *Gadus chalcogrammus,* (formerly *Theragra chalcogramma*) is a key species in the Alaska groundfish complex and a target species for one of the world's largest fisheries. Walleye pollock produce the largest catch of any single species inhabiting the 200-mile U.S. Exclusive Economic Zone. Today, Alaska pollock is the primary "fish-stick fish." It is also the fish used in many fast-food fish sandwiches, and the mild-tasting fish is regularly used in imitation crab.

Pollock is a semipelagic schooling fish widely distributed in the North Pacific Ocean with largest concentrations found in the eastern Bering Sea. Pollock are considered a relatively fast growing and short-lived species and currently represents a major biological component of the Bering Sea ecosystem. In the U.S. portion of the Bering Sea including the Aleutian Islands region, three stocks of pollock are identified for management purposes.

Pollock in the Gulf of Alaska are managed as a single stock independently of pollock in the Bering Sea and Aleutian Islands. The separation of pollock in Alaskan waters into eastern Bering Sea and Gulf of Alaska stocks is supported by analysis of larval drift patterns from spawning locations, genetic studies of allozyme frequencies, mtDNA variability, and microsatellite allele variability.

During 2012, pollock made up 61.9% of the total groundfish catch off Alaska. The pollock catch for 2012 was 1,310,330 metric tons (t), up approximately 2% from 2011.

The 2012 catch of flatfish, which includes yellowfin sole, rock sole and arrowtooth flounder, was 321,530 t or 15.2% of the total 2012 Alaska groundfish catch, down about 2% from 2011.

Pacific cod accounted for 329,040 t or 15.5% of the total 2012 Alaska groundfish catch. The Pacific cod catch was up about 8% from a year earlier.

Other important species (% of total 2012 catch and % change from 2011) are: Atka mackerel 49,020 t (2.3%, down 8%), sablefish 13,850 t (0.7%, up 7%), and rockfish 55,450 t (2.6%, up 8%).

Information from http://www.afsc.noaa.gov/species/pollock.php

PROMPT:

Utilizing the textual, graphical, and tabular data and information above, explain why the research on the NOAA vessel *Oscar Dyson* is important for management of Alaskan pollock fisheries. Remember to include a **CLAIM**, supporting **EVIDENCE**, and **REASONING** as to how the evidence supports your claim.

(NGSS Science & Engineering Practice #7: Engaging in Argument from Evidence)

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